Simple Ground Equipment & Services

Air-to-air refueling

With FMOD sounds, engine blur effects, pilot director lights to signal the refueled aircraft, this module is expected to simplify the in-flight refueling in X-Plane. And our tanker offers on the go the choice of the probe and drogue or of the basket systems to refuel.
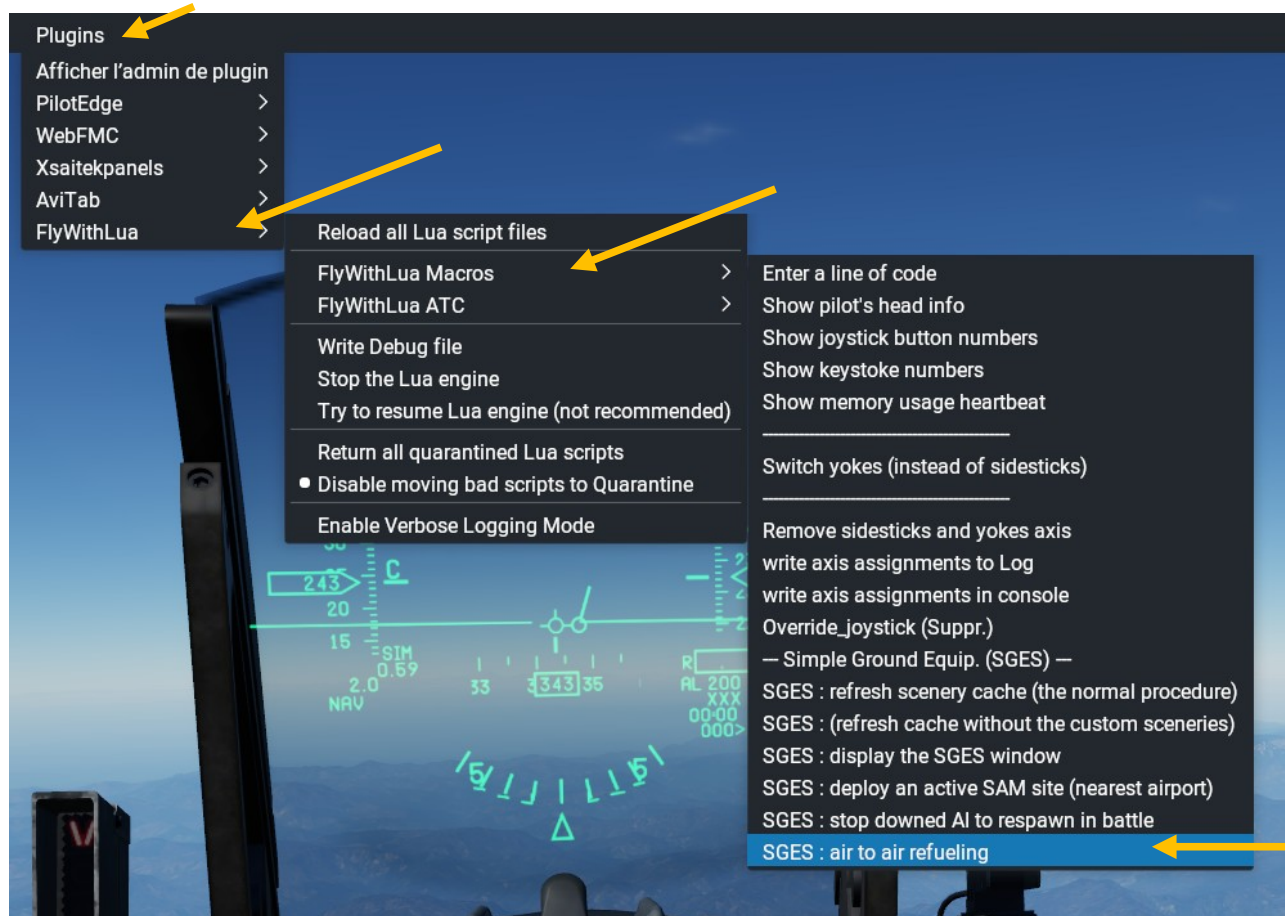
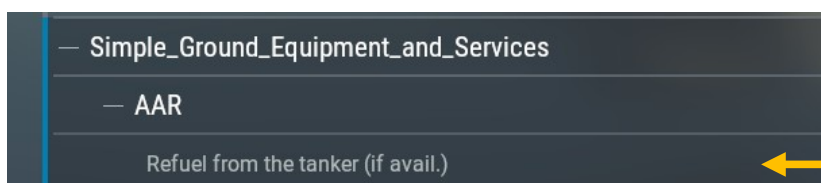# Simple Ground Equipment & Services air to air refueling (AAR)

Calling the refueling tanker

- What always works is to use the drop down menus :

X-Plane *Plugins* menu → *FlyWithLua* → *FlyWithLua Macros* → *SGES : air to air refueling*

- You can select a keyboard key in the X-Plane preferences, to toggle ON and OFF the tanker.

- Alternatively, below 200 KIAS the SGES window becomes available. Open it and untick the box "AAR" to remove the tanker. Here you can only remove it.

Basket or "probe and drogue"

There are three ways to obtain the basket instead of the probe :

1/ select the landing lights to ON to change the refueling system for a basket,

2/ select the taxi light to ON (intended as a backup if the aircraft doesn't have landing lights),

3/ deploy the aircraft hook (intended as a backup if the landing/taxi light switch is inoperative in your aircraft).

Conditions for the tanker to appear

- Pilot's indicated airspeed speed must be **more than 100 knots** and **less than 600 knots**.
- Pilot's aircraft has an in-flight refueling capacity declared in Plane Maker. (*P acf/_has_refuel_rcv 1*)
- The tanker will disappear automatically if the user flies away, quite far from it.

Remark : after requesting the tanker, we take up to 1 second to measure the averaged data required.

Rendezvous with the tanker

You must first establish a stable attitude. Your trend of airspeed variation should be null, your trend of altitude deviation should be null. Your heading must be kept constant. Perfectly compensate your aircraft. *Tip : note all those parameters on a piece of paper in front of you.*

Then call the tanker. You will hear it answering "Clear contact, wet center."

- The tanker appears at the altitude of the pilot.
- The tanker appears at about the airspeed of the pilot.
- The tanker appears at the heading of the pilot.

> DURING ALL THE REFUELING OPERATION, PLEASE MAINTAIN A STABLE FLIGHT PATH. IT IS OF THE UTMOST IMPORTANCE TO KEEP ALL PARAMETERS : SPEED, ALTITUDE AND HEADING.

The tanker appear in contact position but you can fly around and regain the contact position if it is lost.

On top of this, the tanker can do evasive maneuvers to avoid a collision then rejoin its initial position.

Active refueling

The tanker will distribute fuel when *more or less* in the contact position, behind and below.

> WHEN YOUR AIRCRAFT REACHES THE PERFECT POSITION, SGES EASES THINGS BY GLUING THE TANKER (IE TANKER "CAPTURE") TO YOUR AIRCRAFT UNLESS YOU EXIT THE CONTACT POSITION.

The tanker detects the number of internal fuel tanks of any X-Plane model. The tanker fills each one of them to full. To abort refueling before tanks are full, please exit the refueling position early.

At the end of the refueling you will be notified orally "*refueling completed*". It was indeed found unpractical to maintain the precise piloting required and looking at the fuel gauges at the same time.
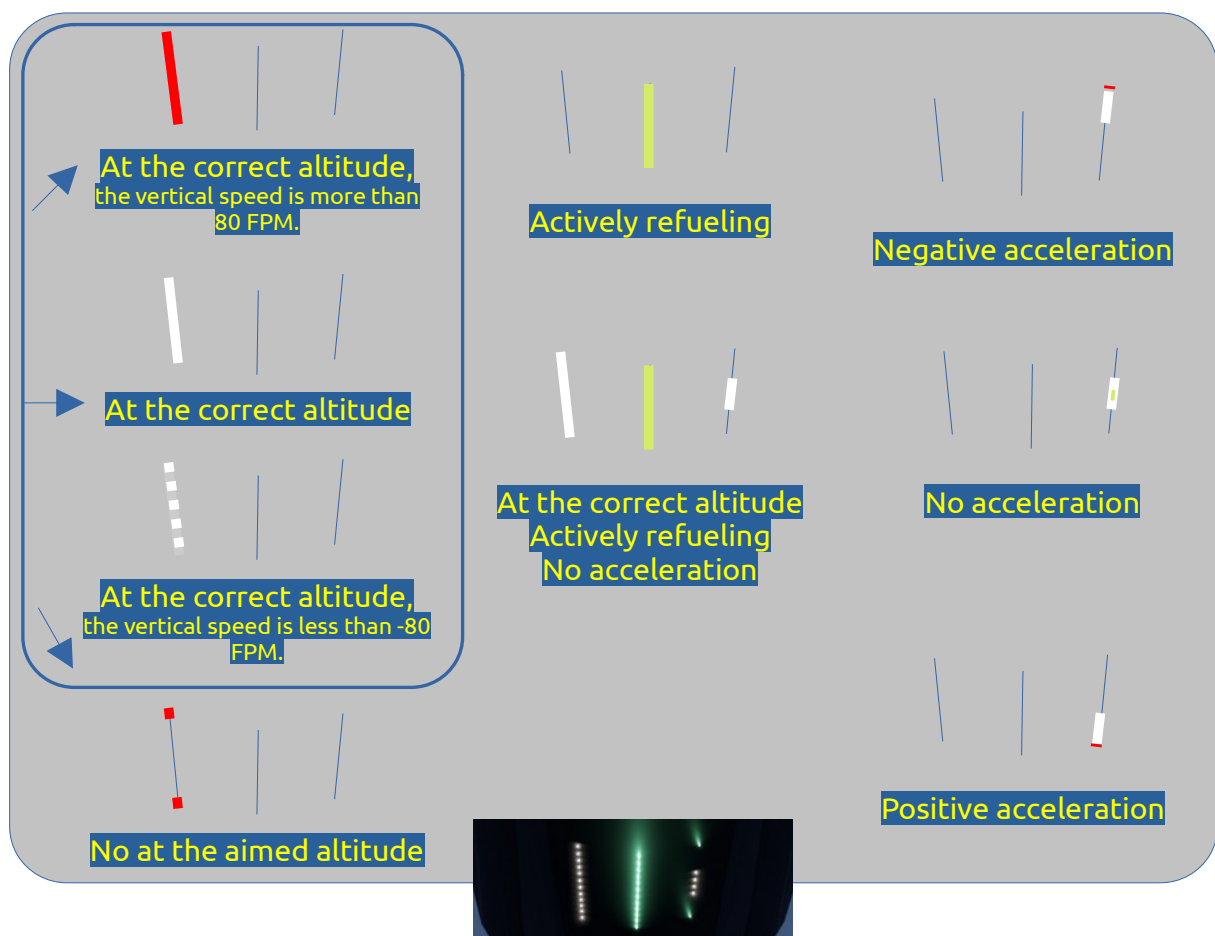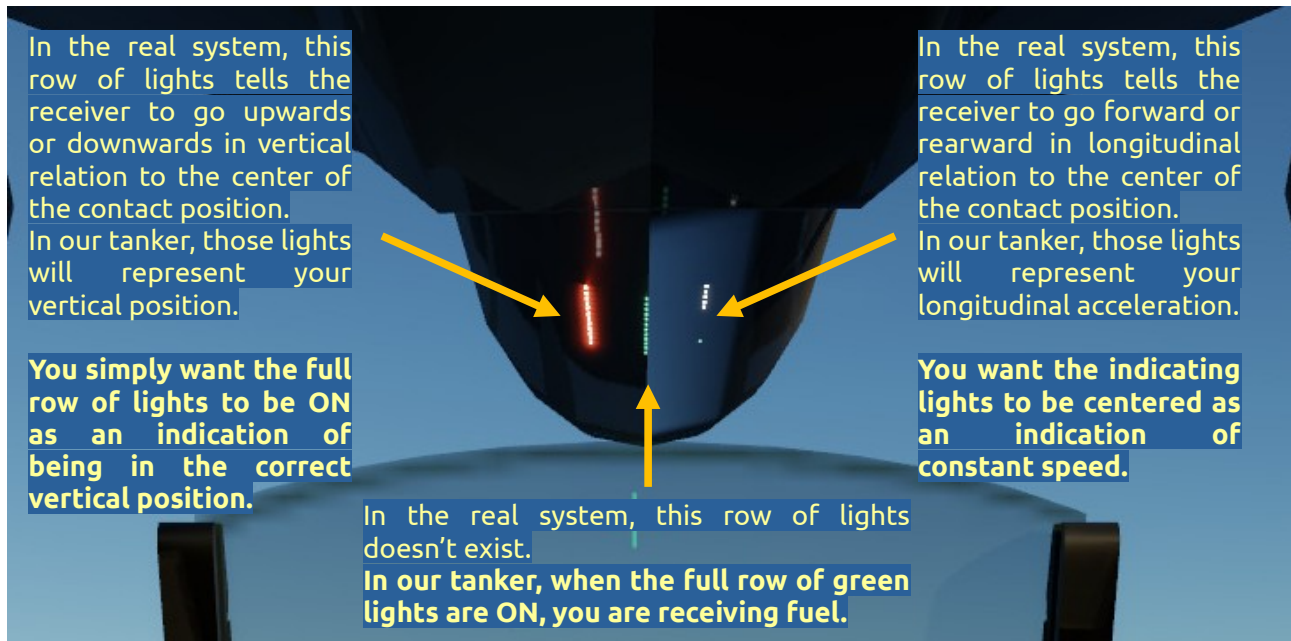
If you want to take fuel at a later point, you need to hide the tanker and call another one.

Remark : the external cans are not served.

> NEVER FOCUS ON THE PROBE OR ON THE BASKET, YOU SHOULD ONLY LOOK AT THE PILOT DIRECTOR LIGHTS.

Pilot director lights

This section describes the visual signaling of the correct contact position to the refueled pilot. This is not the real system but a simplification. You can use exclusively those lights to pilot the airplane in contact. You can forget your own airplane instruments and focus on the director light.

In the real system, this row of lights tells the receiver to go upwards or downwards in vertical relation to the center of the contact position.
In our tanker, those lights will represent your vertical position.

You simply want the full row of lights to be ON as an indication of being in the correct vertical position.

In the real system, this row of lights tells the receiver to go forward or rearward in longitudinal relation to the center of the contact position.
In our tanker, those lights will represent your longitudinal acceleration.

You want the indicating lights to be centered as an indication of constant speed.

In the real system, this row of lights doesn't exist.
In our tanker, when the full row of green lights are ON, you are receiving fuel.

At the correct altitude, the vertical speed is more than 80 FPM.

At the correct altitude

At the correct altitude, the vertical speed is less than -80 FPM.

No at the aimed altitude

Actively refueling

At the correct altitude
Actively refueling
No acceleration

Negative acceleration

No acceleration

Positive acceleration

WHEN YOUR AIRCRAFT REACHES THE CONTACT POSITION, SGES EASES THINGS BY GLUING THE TANKER TO YOUR AIRCRAFT. BUT REMEMBER THAT IS OF THE UTMOST IMPORTANCE TO KEEP ALL PARAMETERS UNCHANGED : SPEED, ALTITUDE AND HEADING, AT ALL TIMES.

When the altitude row turns full red, stop your climb. The tanker is going to do an escape maneuver.

Changing the default refueling behavior (optional)

You should have to make any optional configuration. But you can if you really wish.

The tanker detects the number of internal fuel tanks and fills them to full. Reducing the total number of tanks to fill can speedup the process of filling those selected tanks to full.

Should you desire to fill only the first *x* internal tanks, you can open the aircraft configuration file *Simple_Ground_Equipment_and_Services_CONFIG_aircraft.lua* and add *sges_tank_to_refuel = x* to any aircraft, where *x* is a positive number.

For instance, the FACO F-15 has 5 internal tanks. If you want the tanker to refill only the tanks 1, 2 and 3 (as designed in the X-Plane *Weight and balance* menu), you can add *sges_tank_to_refuel = 3*.

The result will resemble to :

elseif PLANE_ICAO == "F15" then sges_tank_to_refuel = 3

Changing the connection of the tanker-to-refueled (optional)

You can open the aircraft configuration file *Simple_Ground_Equipment_and_Services_CONFIG_aircraft.lua* and add additional parameters to any aircraft. By attempts and errors, one can find a combination which allow a better connection of the probe and drogue in the 3D space. Please add or adjust *sges_refuel_port_lateral = 1.75* and *sges_refuel_port_longitudinal = 12*.

THE FOLLOWING X-PLANE MODELS ALREADY HAVE A CONFIGURATION FROM US :

AV8-B	A319 MPA (refuel from ISCS)
F-4	C-130
F-15	C-17
F-16	VULCAN
F-18	SR-71
F-104	B747-200
F-119	M-346
F-19	HAWK (for dry contact)
F-14	
Tornado	

Changing the tanker (optional)

Open *Simple_Ground_Equipment_and_Services_CONFIG_vehicles.lua*. Go the the section "*IN FLIGHT REFUELING OBJECT*"

You can change our KC-767 by the VSKYLABS KC-135 with something resembling to :

Prefilled_AAR_object = SCRIPT_DIRECTORY .. "../../../../Aircraft/XP12-VSL Test-Pilot SR-71-TB AU v1.0/objects/VSL-M3T-KC135.obj"

We do not distribute it (of course !) so you can only do this if you bought the product from VSKYLABS. Of course, in order to respect the intellectual property rights, please note that you cannot share yourself the associated files from them.

Finally, only our KC-767 has the pilot director lights.

Credits

We use Mister X's static library.

The probe and basket are done in AC3D.

Limitations

Nothing is perfect in this world.

You will soon find that **the basket or the boom will never be perfectly aligned with the receiver during the flight**. While we dampen things with some normalization by your frame rate, it will not be as smooth as in the non digital life.

REFUELING WAS FOUND TO BE FEASIBLE WITH THE SMALL AND AGILE FIGHTER PLANES, **NOT SO MUCH WITH LARGER PLANES** LIKE THE C-130 HERCULES, THE C-17, THE AIRBUS A319 OR THE VULCAN. **THEREFORE, WE AMPLIFIED THE "CAPTURE" OF THE TANKER AROUND THE CONTACT POSITION FOR THE BIGGEST AIRPLANES**. ONE DRAWBACK OF THIS IS THAT THE TANKER WILL APPEAR SUDDENLY JUMPING MORE FREQUENTLY WITH THEM. AN ADVANTAGE OF THIS IS THAT IT ALLOWS THE FUEL TRANSFER TO GO ON FROM THE TANKER TO YOUR AIRPLANE.

Sometimes the tanker disappear. Please call it again in this case. The displacement of the tanker is linked to the FPS. So it may not be smooth.

Advanced addons may not take fuel using X-Plane. You will need to fill the tanks from their menu.

We may expand this module and work again to limit those problems in the future.